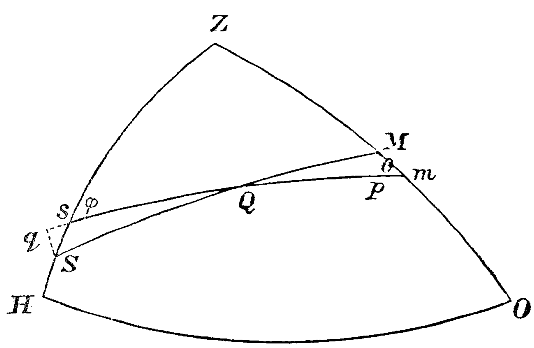
This is not an excessive weight for such a large instrument, and it is rather a question whether it might not be increased considerably. The displacement of about five cubic feet of mercury would equal it, and the cylinders of a length of one foot would give this amount of displacement with a margin. There are no mechanical difficulties in such a construction, though there are points that would require careful consideration. It allows of all the corrections and adjustments that the present instrument allows, and in the case of a small instrument where discs are used in place of what I have termed the box-girder; if required, more than one telescope, that is O. G. and eye-piece, could be used; and even a double telescope, at right angles to the principal telescope, that is, one where the O. G. of one is in front of the eye-piece of the other, and the lines of reference can be engraved on the object-glass of each; or one at some required angle from the first, for differential observations. The friction being so reduced the setting of the instrument actually on the star to be observed could be easily effected with proper clamping and moving arrangements.

A Method for Clearing a Lunar Distance. By John Merrifield.

Let Z be the zenith, HO the horizon, m and s the apparent places of Moon and other object, M and S their true places;



then $m\ s$ is apparent distance, M S the true. With pole Q describe small circles S q and M p, then

$$qp = \text{MS, the true distance.}$$

Now if

d' be the apparent distance,

d „ true „

C „ correction for ☽'s altitude

c „ „ ☉ „

B B 2

then

$$\begin{aligned} \mathrm{SM} &= qp = sm - pm + sq \\ &= d' - \mathrm{C}\,.\cos\theta + c\,.\cos\phi \\ &= d' - \mathrm{C}\left(1 - 2\sin^2\frac{\theta}{2}\right) + c\left(1 - 2\sin^2\frac{\phi}{2}\right) \end{aligned}$$

$$\therefore\; d = d' - (\mathrm{C} - c) + 2\left[\mathrm{C}\,.\sin^2\frac{\theta}{2} - c\,.\sin^2\frac{\phi}{2}\right] \ldots \text{I.}$$

Let

m = moon's apparent altitude. z = moon's apparent zenith distance.

s = other objects' „ „ z' = other objects' „ „ „

$$\mathrm{S}' = \frac{z + z' + d'}{2} \quad \text{and} \quad \mathrm{S} = \frac{m + s + d'}{2}$$

Now

$$\begin{aligned} \sin^2\frac{\theta}{2} &= \frac{\sin(\mathrm{S}' - d')\,.\sin(\mathrm{S}' - z)}{\sin d'\,.\sin z} \\ &= \frac{\sin\dfrac{z' + z - d'}{2}\,.\sin\dfrac{z' + d' - z}{2}}{\sin d'\,.\cos m} \\ &= \frac{\sin\left[90 - \dfrac{m + s + d'}{2}\right].\sin\dfrac{m + d' - s}{2}}{\sin d'\,.\cos m} \\ &= \cos\mathrm{S}\,.\sin(\mathrm{S} - s)\,.\operatorname{cosec} d'\,.\sec m. \end{aligned}$$

Similarly

$$\sin^2\frac{\phi}{2} = \cos\mathrm{S}\,.\sin(\mathrm{S} - m)\operatorname{cosec} d'\,.\sec s.$$

From I

$$\begin{aligned} d &= d' - (\mathrm{C} - c) + 2\cos\mathrm{S}\,.\operatorname{cosec} d'\,[\mathrm{C}\,.\sin(\mathrm{S} - s)\,.\sec m - c\,.\sin(\mathrm{S} - m)\sec s] \\ &= d' - (\mathrm{C} - c) + 2\cos\mathrm{S}\,.\operatorname{cosec} d'\,[\mathrm{M} - \mathrm{N}] \end{aligned}$$

if

$$\mathrm{M} = \mathrm{C}\,.\sin(\mathrm{S} - s)\sec m,$$

and

$$\mathrm{N} = c\,.\sin(\mathrm{S} - m)\sec s.$$

Of course a similar formula could be obtained by taking

$$\cos\theta = 2\cos^2\frac{\theta}{2} - 1 \text{ and } \cos\phi = 2\cos^2\frac{\phi}{2} - 1 \text{ in 3rd line.}$$

Example.—The apparent altitude of the Moon is 54° 17′ 46″, that of the Sun 63° 18′ 48″; the apparent central distance is 41° 17′ 14″. The Sun's correction for altitude is 25″, the Moon's correction 33′ 24″. Find true distance.

$m = 54° \ 17' \ 46''$ sec ·233888

$s = 63 \ 18 \ 48$ ... ... sec ·347646

$d' = 41 \ 17 \ 14$ ... ... cosec ·180565

2) 158 53 48

$S = 79 \ 26 \ 54$ ... ... cos 9·262741

$S - s = 16 \ 8 \ 6$ sin 9·443891

$S - m = 25 \ 9 \ 8$ ... ... sin 9·628414

$C = 33' \ 24'' = 2004''$ log 3·301898

$c =$ 25 ... ... log 1·397940

$M =$ 954 28 log 2·979677

$N = 23{\cdot}66$ log 1·374000

$M - N = 930{\cdot}62$ log 2·968772

log 2·412078

$C \, . \sin \frac{\theta}{2} - c \, . \sin \frac{\phi}{2} = 258{\cdot}3''$

2

$516{\cdot}6 = +8' \ 36''{\cdot}6$

$C - c = -32 \ 59$

$-24 \ 22{\cdot}4$

$d' = 41 \ 17 \ 14$

True distance $d = 40 \ 52 \ 51{\cdot}6$

Borda's method gives ... ... $d = 40 \ 52 \ 58$

Krafft's „ „ ... ... $d = 40 \ 52 \ 30$

This question is taken at random from a work on Nautical Astronomy.

Abnormal Appearance of Jupiter's Satellite IV. while in Transit on March 12. By Henry Pratt.

At 10.30 P.M. the satellite was seen as a conspicuous spot on the great white belt just south of the equatorial zone, and it was observed until 11^{h} with power of 270, maintaining the whole time the same appearance, which I think is unusual even among the many dark transits which have been observed. Its form was the most singular feature, for instead of being round it was much elongated (elliptical or gibbous), and its major axis was not quite perpendicular to *Jupiter's* equator, but slightly in-